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NATIONAL DAM INSPECTION PROGRAM. LAKE ALEEDA DAM (NDI-ID NUMBER--ETC(U)
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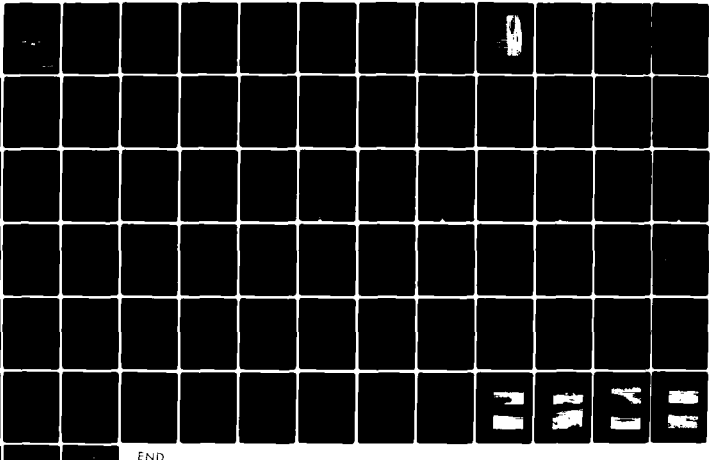

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DELAWARE RIVER BASIN
TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

LAKE ALEEDA DAM

NDI ID NO. PA-00557
DER ID NO. 40-219
SCS ID NO. PA-530

ALEEDA DEVELOPMENT CORPORATION, INC.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Distribution Unlimited
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Contract No. DACW31-79-C-0015

Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

MAY 1979

DELAWARE RIVER BASIN

TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

(6) National Dam Inspection Program

LAKE ALEEDA DAM

(NDI-ID No. PA-00557)
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NATIONAL DAM INSPECTION PROGRAM

(15) DACW31-79-C-0015

Prepared By

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
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P.O. Box 1963
Harrisburg, Pennsylvania 17105

For

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

(11) May 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated 'Probable Maximum Flood' for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

DELAWARE RIVER BASIN

TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

LAKE ALEEDA DAM

NDI NO. PA-00557
DER ID No. 40-219
SCS ID No. PA-530

ALEEDA DEVELOPMENT CORPORATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

MAY 1979

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NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Lake Aleeda NDI ID No. PA-00557/DER ID No. 40-219 SCS ID No. PA-530
Owner:	Aleeda Development Corporation, Inc.
State Located:	Pennsylvania
County Located:	Luzerne
Stream:	Tributary to Bear Creek
Date of Inspection:	3 May 1979
Inspection Team:	Gannett Fleming Corddry and Carpenter, Inc. Consulting Engineers P.O. Box 1963 Harrisburg, Pennsylvania 17105

Based on visual inspection, available records, calculations and past operational performance, Lake Aleeda Dam is judged to be in good condition. The spillway can pass the Probable Maximum Flood (PMF) without overtopping of the dam. The spillway capacity is rated as adequate. However, auxiliary spillway discharges will flow along the toe of the embankment, thus creating an erosion hazard.

There is no evidence of stability problems with the embankment. Because of the steep downstream slope and because the embankment is homogeneous, its stability is only considered marginal.

The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) With the assistance of a professional engineer experienced in the design and construction of dams, provide an adequate exit channel at the auxiliary spillway to train flow away from the toe of the embankment, and grade the auxiliary spillway to its design elevations. Erosion protection should be provided at the junction of the embankment and the auxiliary spillway.

(2) Install four or more observation wells, or other instrumentation, downstream of the axis of the embankment. One well, or other instrumentation, should be located in the vicinity of the seepage area in the outlet channel. The others should be at appropriate locations to determine general water levels in the downstream embankment to the right of the conduit. Data collected from observation wells or other instrumentation should be utilized by a professional engineer, as noted above, in evaluating the stability of the structures and assessing piping potential. Continue to observe wet areas and seepage downstream from the embankment. If conditions worsen appropriate action should be taken to control apparent seepage with properly designed drains.

(3) Ensure that the outlet works gate is operable. Operate and maintain the gate at least annually to ensure its operation if required.

(4) As part of the regular maintenance program, remove trees on and near the embankment.

In addition, it is recommended that the Owner modify his operational procedures as follows:

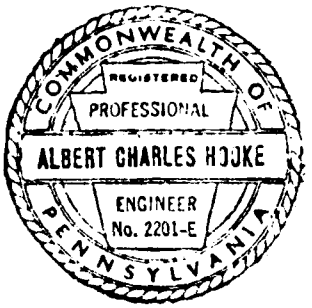
(1) Develop a detailed emergency operation and warning system for Lake Aleeda Dam.

(2) Provide round-the-clock surveillance of Lake Aleeda Dam during periods of unusually heavy rains.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

(4) Institute a program of detailed annual inspections by a professional engineer experienced in the design and construction of dams. Use the results to determine if remedial measures are necessary. The first inspection should include the conditions in the riser and conduit. Draw down the pool, if necessary, to accomplish this.

Submitted by:



GANNETT FLEMING CORDDRY
AND CARPENTER, INC.

A. C. HOOKE
Head, Dam Section

Date: 22 June 1979

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

LAKE ALEEDA DAM

Overview

DELAWARE RIVER BASIN

TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

LAKE ALEEDA DAM

NDI ID No. PA-00557
DER ID No. 40-219
SCS ID No. PA-530

ALEEDA DEVELOPMENT CORPORATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Lake Aleeda Dam is a homogeneous earthfill embankment, which extends for 580 feet. It is 27 feet high at maximum section. The main spillway is a drop spillway. It consists of a 16-foot high, 3-foot diameter, reinforced concrete pipe (RCP) riser that connects to a 24-inch diameter RCP conduit, which extends under the embankment. An anti-vortex screen is attached to the top of the riser. The riser crest is 6.5 feet below the design top elevation of the dam.

The outlet works consists of a 12-inch diameter steel pipe extending from the headwall at the upstream toe to the riser. A 12-inch sluice gate is provided at the inlet. The gate stem extends along the upstream slope of the embankment to above the normal pool elevation.

The auxiliary spillway is a grass-lined channel at the left abutment of the dam. At the earthen control section, the crest is 46 feet long and 4 feet below the design top elevation of the embankment. This is 2.5 feet above the main spillway crest. The various features of the dam are shown on the Plates at the end of the Report and on the Photographs in Appendix D.

b. Location. The dam is located on a tributary to Bear Creek approximately 7.6 miles east of Wilkes-Barre, Pennsylvania. Lake Aleeda Dam is shown on the 1973 photo-revision to USGS Quadrangle, Pleasant View Summit, Pennsylvania, with coordinates N41°14'45" - W75°43'00" in Luzerne County, Pennsylvania. Part of the reservoir is shown on the photo-revision to USGS Quadrangle, Avoca, Pennsylvania. The dam is 5.0 miles upstream from Bear Creek Lake dam, which is on Bear Creek. Lake Aleeda Dam releases water into Bear Creek Lake. The location map is shown on Plate 1.

c. Size Classification. Small (27 feet high, 818 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Lake Aleeda Dam (Paragraph 5.1c.).

e. Ownership. Aleeda Development Corporation, Inc., R.D. 2, Wilkes-Barre, Pennsylvania.

f. Purpose of Dam. Recreation.

g. Design and Construction History. Lake Aleeda Dam was designed between 1962 and 1963 by the Soil Conservation Service (SCS) of the U.S. Department of Agriculture. A review of the design by the Pennsylvania Water Resources and Power Board resulted in the request that the original design be modified to enable the dam to pass the 100-year flood without flow discharging over the auxiliary spillway. It was also requested that the topwidth of the dam be increased to 14 feet. These changes were made. Construction of the dam was started in July, 1964. The records only refer to the Contractor as a Mr. Grab. Both the SCS and the Commonwealth inspected the construction periodically. The construction was completed in July, 1965.

At some later time, sloughing occurred on the downstream slope to the right of the main spillway. The Owner placed a perforated drain pipe along the toe of the embankment in this area and placed a loose shale fill along the slope, which flattened it slightly. The Owner also placed a thin layer of fill over the riprap on the upstream slope to improve the appearance of the dam.

The dam was originally called Keil Lake Dam.

h. Normal Operational Procedure. The reservoir is normally maintained at spillway crest level. The gate on the outlet works is normally closed.

1.3 Pertinent Data.

a. Drainage Area. (square miles.)	0.6
b. Discharge at Damsite. (cfs.)	
Maximum known flood at damsite	70
Outlet works at main spillway crest	26

b. Discharge at Damsite. (cfs) (cont'd.)

Spillway capacity at maximum pool elevation

Main spillway	69
Auxiliary spillway	1,310
Total	1,370

c. Elevation. (feet above msl.)

Top of dam (design)	1,926.5
Top of dam (existing)	1,926.5
Maximum pool	1,926.5
Normal pool (main spillway crest)	1,920.0
Upstream invert outlet works	1,908.5
Streambed at toe of dam	1,900.0

d. Reservoir Length. (miles.)

Normal pool	.38
Maximum pool	.40

e. Storage. (acre-feet.)

Normal pool	400
Maximum pool	818

f. Reservoir Surface. (Acres.)

Normal pool	61
Maximum pool	68

g. Dam.

Type	Homogeneous Earthfill
Length (feet)	580
Height (feet)	27

g. Dam. (cont'd.)

Topwidth (feet)	
Design	14
Existing	varies-15 to 16
Side Slopes	
Upstream	1V on 3H
Downstream	1V on 2H
Zoning	None
Cutoff	Cutoff trench filled with embankment material.
Grout Curtain	None

h. Diversion and Regulating Tunnel. None

i. Spillway.

Main Spillway	
Type	Drop Spillway, a 3-foot diameter RCP Riser.
Length of Weir (feet).	9.4
Crest Elevation	1920.0
Upstream Channel	Reservoir

i. Spillway. (continued)

Downstream Channel	A 24-inch diameter RCP conduit, 92 feet long, extending under the embankment to a riprap stilling pool in the natural stream.
Auxiliary Spillway	
Type	Grass-lined earth cut with control section.
Length of Weir (feet)	46
Crest Elevation	1922.5
Upstream Channel	Short sloped approach to reservoir
Downstream Channel	The natural stream overbank, by the toe of the embankment, to the natural stream.

j. Regulating Outlets.

Type	12-inch diameter steel pipe, extending to main spillway riser.

j. Regulating Outlets. (Cont'd)

Length (feet)	20.0
Closure	12-inch sluice gate on the upstream end.
Access	Valve stem extends along upstream embankment slope to above normal pool elevation.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. Although the dam was designed by the SCS, the SCS Representative stated that all records of the dam were destroyed when the regional office in Bloomsburg was flooded during Tropical Storm Agnes in June, 1972. The data available consist of the design drawings, limited design calculations, and the analysis of the design by the Pennsylvania Water Power and Resources Board.

b. Design Features. The dam and appurtenances are described in Paragraph 1.2a. The design features are shown on the Plates at the end of the report and on the Photographs in Appendix D.

A plan of the reservoir and damsite is shown on Plate 2. A section of the embankment is shown on Plate 3. The embankment is shown on Photographs A, B, and D. The main spillway and outlet works is shown on Plates 3, 4, and 5 and on Photographs C and D. The auxiliary spillway is shown on Plates 2, 3, and 4 and on Photographs F, G, and H.

There are no drawings available for the drain pipe or the embankment fill placed as a subsequent modification to the dam.

c. Design Considerations. Plate 2 indicates that the cutoff trench only extends under the length of the embankment that is below normal pool elevation. Current standard practice would require that the cut-off trench extend under the entire embankment. Although the main spillway design has been used successfully by the SCS for many years, it appears that there is a potential to develop cavitation during certain flow conditions.

2.2 Construction.

a. Data Available. Construction data available are limited to the monthly progress reports sent by Adelaide (Mrs. Carl O.) Keil and to the periodic inspection reports and construction photographs by the Commonwealth. The only adverse comment in the reports is the discovery of a small spring in the bedrock of the right abutment cutoff trench. A monthly progress report stated that the spring was "easily eliminated", but the method of elimination was not disclosed.

b. Construction Considerations. The available records do not raise any concerns about the construction of the dam.

2.3 Operation. There are no formal records of operation. Based on information from the Owner of the dam, all structures have performed satisfactorily, except for the sloughing previously noted.

2.4 Evaluation.

a. Availability. Engineering data was provided by the Bureau of Dam Safety, Obstructions, and Storm Water Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER), and by the Owner, Aleeda Development Corporation, Inc. The Owner made available Carl O. Keil, an officer of the Corporation, for information during the visual inspection. The SCS also researched their files, without success, for additional information upon request of the inspection team.

b. Adequacy. The type and amount of design data and other engineering data is limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is good, with some deficiencies as noted herein. The locations of deficiencies are shown in Appendix B on Plate B1. Survey data acquired during this inspection are presented in Appendix B. Difficulties with the survey datum are explained in Appendix B. On the day of the inspection, the pool was at the main spillway crest elevation.

b. Embankment. The embankment appears in good condition. The grass cover is in good condition, as is the riprap on the upstream slope. The upper part of the upstream slope is covered with a thin layer of fill, as noted previously (Photograph A). A loose shale fill covers most of the downstream slope (Photograph D). This fill is warped around the outlet pipe on a fairly steep slope. Low brush is growing sporadically on both slopes. A small tree is growing at the junction of the auxiliary spillway and the embankment (Photograph G). At the junction of the embankment and the auxiliary spillway, the embankment has no protection from erosive flow in the auxiliary spillway. Trees are growing close to the toe to the right of the main spillway. Two seepage areas were observed. The first is at the downstream toe, just to the right of the conduit (Photograph D). The Owner reported that this is the outlet of the toe drain, which was installed as a modification to the dam. A clear flow of 2 to 3 gpm was discharging from the pipe. "Yellow-boy" precipitate was noted in this area. The second seepage area is at the left bank of the natural channel, about 50 feet downstream of the toe. Clear flow, with "Yellow-boy" precipitate, of 0.5 gpm was observed.

The survey performed for this inspection revealed that the embankment slopes agree approximately with the design drawings. The measured topwidth is 1 to 2 feet wider than the design topwidth. The top of the embankment is at or above the design elevation.

c. Appurtenant Structures. The main spillway appears in good condition. It was not possible to inspect the riser or conduit because of their small size and because of the flow on the day of the inspection. As noted in Appendix B, the downstream invert of the conduit is apparently 3.0 feet below its design elevation. The only visible part of the outlet works is the gate stem (Photograph C). It is rusty and has obviously not been operated recently. The Owner stated that it has not been operated since the dam was constructed. He declined to operate the outlet works because of his concern that it might remain in the open position, thus drawing down the reservoir.

The auxiliary spillway is in fair condition. The spillway crest measures 46 feet. The survey performed for this inspection revealed that the crest is 0.3 foot below its design elevation. The area downstream of the crest is unevenly graded and appears higher than the crest (Photograph G). Flows over the auxiliary spillway would discharge along the toe of the embankment (Photograph H). The bottom of the auxiliary spillway is soft and wet in areas. Since this area is above the pool elevation, the condition is caused by the natural groundwater in the adjacent hillside. It is therefore of no concern.

d. Reservoir Area. The reservoir has generally gentle slopes. The watershed has minor development, consisting of the homes around the lake. Access to the dam is via a public road.

e. Downstream Channel. The stream flows from the dam for 100 feet to a public road. The stream passes under the roadway embankment, which is about 10 feet high, in two 6-foot diameter culverts (Photograph E). The stream then flows for 4.9 miles along an uninhabited reach to Bear Creek Lake.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at main spillway crest, Elevation 1920.0, with excess inflow discharging over the spillway and into the stream, which flows into Bear Creek Lake 4.9 miles downstream. A 12-inch diameter steel pipe discharges water from the reservoir. Flows in the line are regulated by a 12-inch gate at the intake structure. Since Lake Aleeda Dam functions as a recreation dam, the gate on the discharge line, which is solely used for drawdown, is usually closed.

4.2 Maintenance of Dam. The dam is visited at least weekly by an officer of the corporation who is responsible for observing the general condition of the dam and appurtenant structures and for assessing any changes or deficiencies. The Owner does not make formal inspections of the dam. The brush and grass on the dam are cut frequently.

4.3 Maintenance of Operating Facilities. The gate on the outlet works is not maintained.

4.4 Warning Systems in Effect. The Owner stated that there is no emergency operation and warning plan. He stated that, should a dam failure be imminent, he would contact the responsible person at Bear Creek Dam.

4.5 Evaluation of Operational Adequacy. The maintenance of the embankment is good. Because the outlet works gate has not been maintained, its operation is uncertain and it cannot be relied upon to function in case of an emergency. An emergency operation and warning system is necessary to mitigate any hazards, should conditions of stress at the dam become evident.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features

a. Design Data. As noted in Paragraph 2.1, the only design data available are those contained in the PennDER files. Some of the original design data is in those files. The Pennsylvania Water and Power Resources Board analyzed the design. A summary of their analysis is on file. The available data indicates that the dam was designed, using standard SCS criteria, to pass the Water Resource and Power Board curve "C". The design discharge for the auxiliary spillway is indicated as 1,270 cfs with the pool at the top of the dam. This was estimated using a 50-foot bottom width. The main spillway capacity was estimated at 58 cfs, neglecting tailwater and assuming the pool to be 2.0 feet below the top of the dam. The dam was designed to pass the 100-year storm without flow over the auxiliary spillway. The drainage area was estimated at 0.75 square mile; this was apparently taken from small scale USGS mapping.

Using more recent, large scale, USGS mapping the drainage area computes to be 0.6 square mile. The main spillway capacity used in this report is 60 cfs, which includes the effects of the estimated tailwater elevation based on control at the public road immediately downstream of the dam. The auxiliary spillway discharge capacity is estimated at 1,310 cfs with a bottom width, as measured for this inspection, of 46 feet (Appendix C). The Owner's design computations for the auxiliary spillway capacity seem unduly conservative.

b. Experience Data. The Owner has not reported any hydraulic problems with the dam. He reported that the flood of record occurred during Tropical Storm Agnes, when the maximum pool level was below the auxiliary spillway crest. The estimated discharge in Paragraph 1.3 is assuming the pool at auxiliary spillway crest.

c. Visual Observations.

(1) General. The visual inspection of Lake Aleeda dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The lack of erosion protection at the junction of the embankment and the auxiliary spillway could result in erosion of the embankment during a flood.

(3) Appurtenant Structures. The bars of the trashrack on the main spillway are closely spaced. The trashrack, therefore, could be easily clogged which would reduce the main spillway discharge capacity. As the main spillway discharge is negligible compared to the auxiliary spillway discharge, this potential clogging of the trashrack is not considered a deficiency. The outlet works gate provides adequate upstream closure. At present, the drawdown capabilities are uncertain because it is not certain the gate is operable.

The width of the auxiliary spillway is not indicated on the design drawings. The auxiliary spillway does not appear to have been constructed entirely in accordance with the design drawings. The design alignment is shown on Plate 3. A plan of the auxiliary spillway, to small scale, is shown on Plate 2. Both these plates indicate that it was the intention of the design to direct the flow away from the toe of the embankment. At present, the potential for flow along the toe of the dam is a serious erosion hazard. The uneven grading in the auxiliary spillway could change the hydraulic control in the auxiliary spillway and cause a reduction in its capacity.

(4) Reservoir Area. No conditions were observed in the reservoir area or watershed that might present significant hazard to the dam. The assessment of the dam is based on existing conditions, and the effects of future development are not considered. Access to the dam is good.

(5) Downstream Conditions. The roadway embankment immediately downstream from the dam will increase tailwater at the dam. This will decrease the main spillway capacity slightly but will have no effect on the auxiliary spillway capacity. The small size of the culverts are not considered to be a deficiency. The downstream conditions indicate the only hazard presented by the dam is to Bear Creek Lake Dam and its surrounding homes. A Phase I National Dam Inspection Report has previously been prepared for Bear Creek Lake Dam, which is a high hazard dam of small size with a seriously inadequate spillway. There are 8 dwellings that could be flooded by a failure of Bear Creek Lake Dam. Because the failure of Lake Aleeda Dam could cause the failure of Bear Creek Lake Dam, a high hazard classification is warranted for Lake Aleeda Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of neers (OCE) for the size (Small) and hazard potential (High) of Lake Aleeda Dam, the Spillway Design Flood (SDF) is between one-half of the Probable Maximum Flood (PMF) and the PMF. Because Bear Creek Lake Dam downstream has a SDF equal to the 1/2 PMF, the 1/2 PMF is selected as the SDF for Lake Aleeda Dam.

(2) Description of Model. The watershed was modeled with the HEC-1DB computer program. The HEC-1DB computer program computes a PMF runoff hydrograph and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. The PMF inflow to Lake Aleeda was determined and routed through the dam. Identical methods were used for various percentages of the PMF.

(3) Summary of Results. Pertinent results are tabularized at the end of Appendix C. The analysis reveals that Lake Aleeda Dam can pass the PMF with 1.3 feet of freeboard.

(4) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix C. Since the spillway can pass the PMF without the overtopping of the dam, the spillway capacity is rated as adequate. This rating is dependent on conditions being improved in the exit channel of the auxiliary spillway.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Lake Aleeda Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for various features.

(2) Embankment. The Owner reported that the original lake bottom was a peat bog. This is confirmed by the exploration program performed prior to the design of the dam. The results of the exploration program indicate traces of bog iron ore in some of the samples. The "yellow-boy" observed at the seepage areas indicates that some of the flow is underseepage, with the water collecting the precipitate. The seepage to the left of the outlet channel is not excessive and may be caused by natural ground water conditions. The seepage from the drain pipe to the right of the conduit outfall is significant. The Owner was asked if a filter was placed around the pipe. He could not recollect the details of the construction. This is discussed in Paragraph 6.1b.

The trees on or near the embankment are undesirable. The increased topwidth is the result of placement of the shale fill on the slopes. The brush on the embankment is small and limited in extent. It is not considered a deficiency.

(3) Appurtenant Structures. The conduit and riser have not been inspected since the construction of the dam. Since the joints of concrete pipes that are founded on soil tend to separate, an inspection would be prudent.

b. Design and Construction Data. The records state that no stability analysis was performed for the embankment. The available foundation exploration data provide only a visual identification of the soils. Neither a record of further testing nor a formal report is available for the foundation material. The information indicates that the foundation soils are mostly a clay (CL). It is surmised that the embankment was constructed of this material.

The extent of the sloughing that occurred on the downstream slope after the construction of the dam is not known. The shale that was placed on the downstream slope is not compacted. Although it flattened the slope slightly, it is not felt that it made a significant improvement to the embankment stability.

The quantity of seepage from the drain pipe along the embankment toe is not excessive. Although no fines were observed in the seepage, the probable lack of a filter around the pipe is of concern. Because there are no drainage zones in the embankment, the phreatic line is probably close to the downstream slope resulting in a considerable portion of the embankment being saturated. The downstream slope of 1V on 2H is steeper than what would be used under current design practice for a homogeneous earthen embankment. Without further information, the stability of the embankment can only be considered marginal.

c. Operating Records. There are no formal records of operation. According to the Owner, no stability problems, other than the sloughing previously noted, have occurred over the operational history of the dam.

d. Postconstruction Changes. The post-construction addition of a toe drain and fill on the downstream slope is discussed in Paragraph 1.2g.

e. Seismic Stability. Lake Aleeda Dam is located in Seismic Zone 1. Normally it can be considered that, if a dam in this zone has adequate factors of safety under static loading conditions, it can be assumed safe for any expected earthquake loading. However, since there are no formal static stability analyses, the theoretical seismic stability of Lake Aleeda Dam is not known.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety.

(1) Based on the visual inspection, available records, calculations, and past operational performance, Lake Aleeda Dam is judged to be in good condition. The existing spillway will pass the PMF without overtopping of the dam. The spillway capacity is rated as adequate. However, auxiliary spillway discharges will flow along the toe of the embankment, thus creating an erosion hazard.

(2) There is no formal stability analysis for Lake Aleeda Dam. There is no evidence of problems presently threatening the stability of the embankment. However, because of the steep downstream slope, and because the embankment is homogeneous, the stability of the embankment is only considered marginal.

(3) The visual inspection revealed some deficiencies, which are summarized below for the various features.

Feature and Location	Observed Deficiencies
Embankment:	
Upstream slope	Tree in slope near auxiliary spillway.
Downstream toe	Trees near toe, seepage.
Junction with auxiliary spillway	No erosion protection.

Feature and Location	Observed Deficiencies
Outlet Works:	
	Uncertain operation.
Auxiliary Spillway:	
	Uneven grading, erosion hazard at toe of embankment.

b. Adequacy of Information. The information available is such that an assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately.

(1) With the assistance of a professional engineer experienced in the design and construction of dams, provide an adequate exit channel at the auxiliary spillway to train flow away from the toe of the embankment and grade the auxiliary spillway to its design elevations. Erosion protection should be provided at the junction of the embankment and the auxiliary spillway.

(2) Install four or more observation wells, or other instrumentation, downstream of the axis of the embankment. One well, or other instrumentation, should be located in the vicinity of the seepage area in the outlet channel. The others should be at appropriate locations to determine general water levels in the down-

stream embankment to the right of the conduit. Data collected from observation wells or other instrumentation should be utilized by a professional engineer, as noted above, in evaluating the stability of the structures and assessing piping potential. Continue to observe wet areas and seepage downstream from the embankment. If conditions worsen, appropriate action should be taken to control apparent seepage with properly designed drains.

(3) Ensure that the outlet works gate is operable. Operate and maintain the gate at least annually to ensure its operation if required.

(4) As part of the regular maintenance program, remove trees on and near the embankment.

b. In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Lake Aleeda Dam.

(2) Provide round-the-clock surveillance of Lake Aleeda Dam during periods of unusually heavy rains.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

(4) Institute a program of detailed annual inspections by a professional engineer experienced in the design and construction of dams. Use the results to determine if remedial measures are necessary. The first inspection should include the conditions in the riser and conduit. Draw down the pool, if necessary, to accomplish this.

DELAWARE RIVER BASIN

TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

LAKE ALEEDA DAM

NDI ID No. PA-00557
DER ID No. 40-219
SCS ID No. PA-530

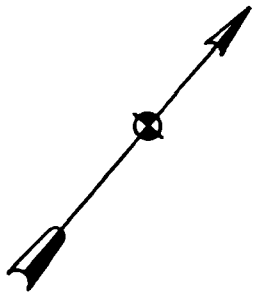
ALEEDA DEVELOPMENT CORPORATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

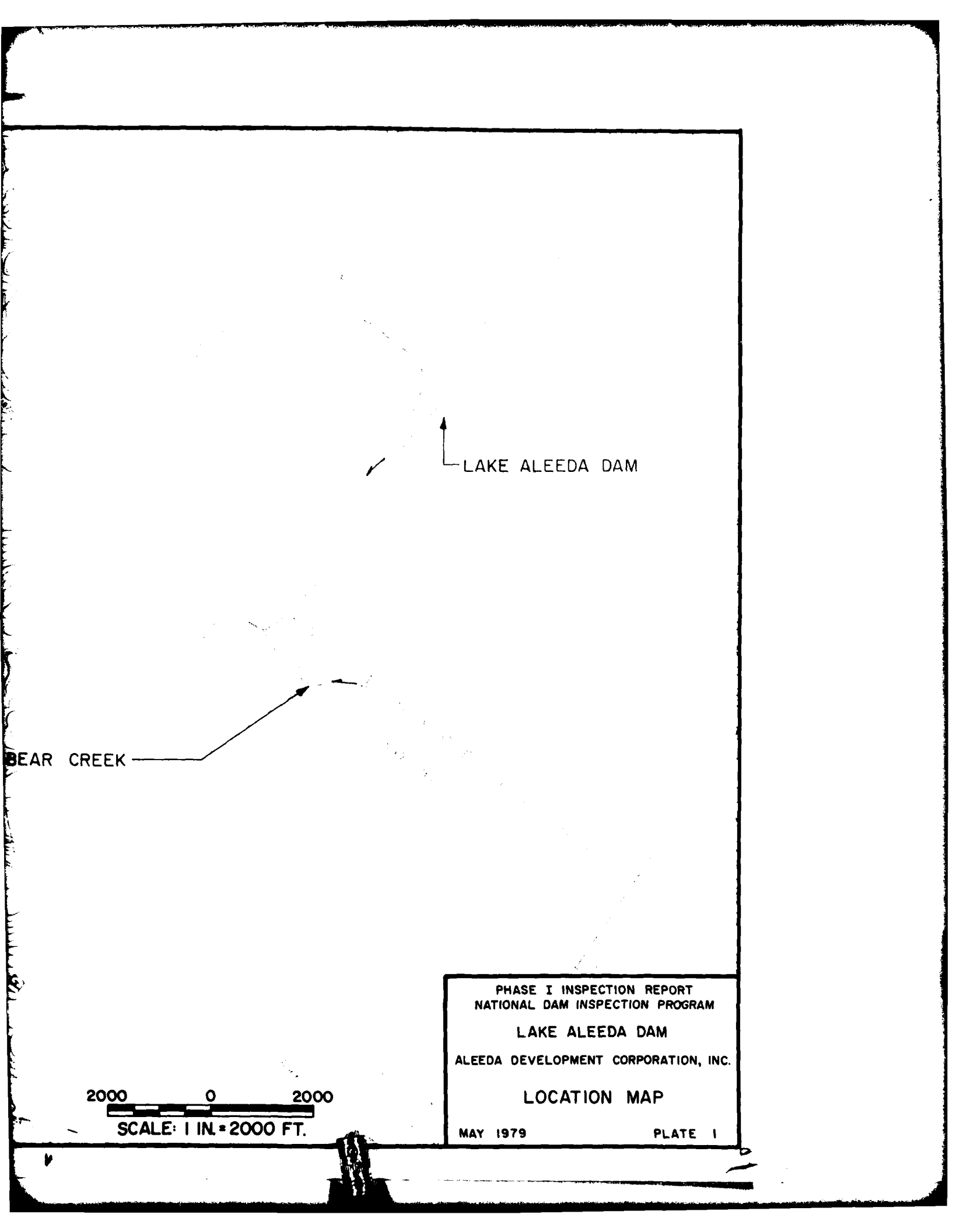
MAY 1979

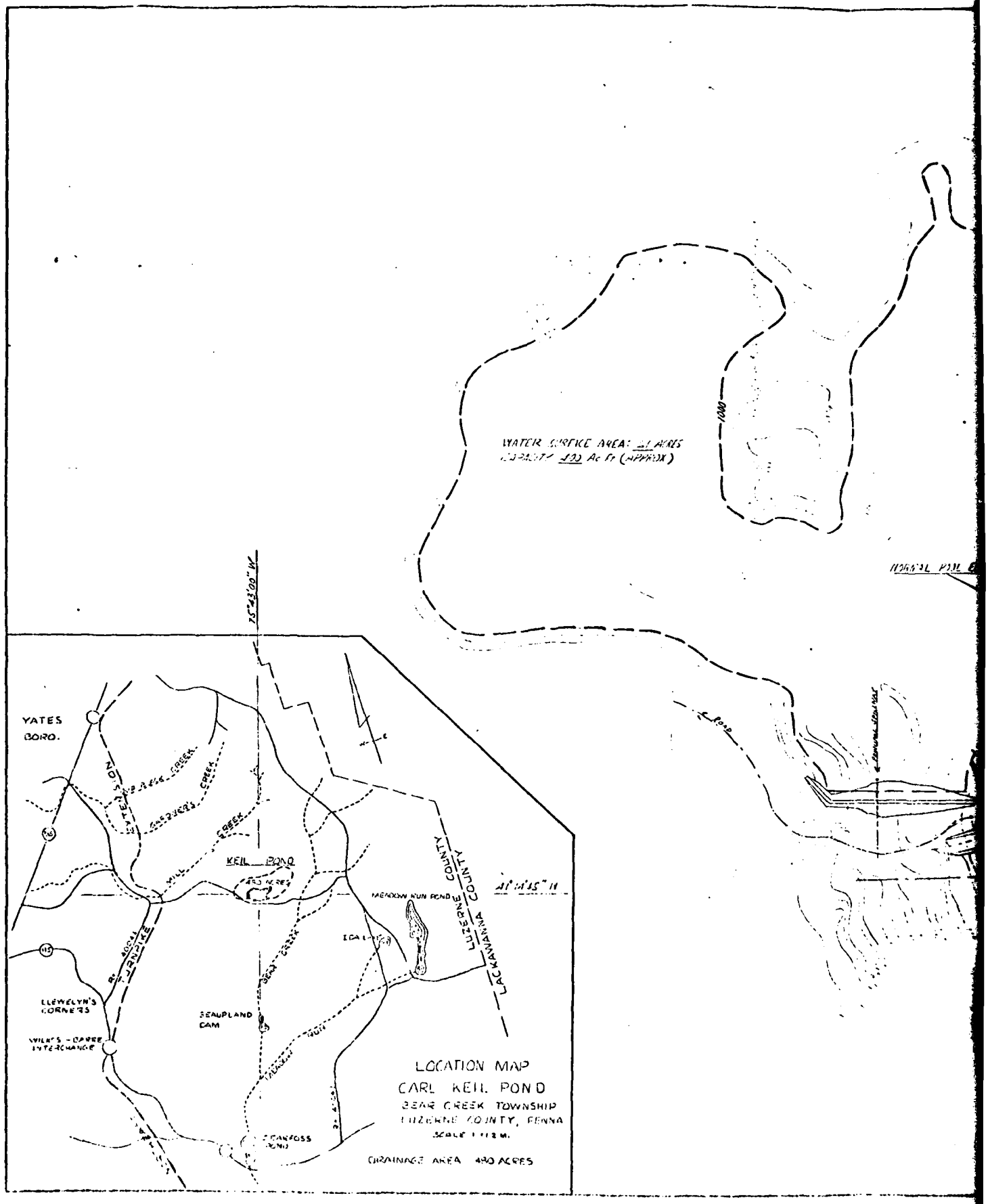
PLATES

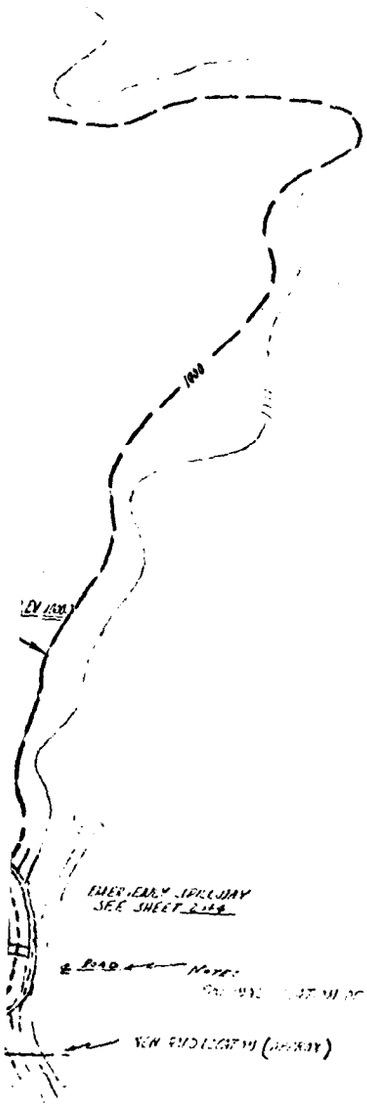


BEAR

BEAR CREEK LAKE DAM


LAKE ALEEDA DAM
BEAR CREEK
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE ALEEDA DAM
ALEEDA DEVELOPMENT CORPORATION, INC.
LOCATION MAP
MAY 1979
PLATE 1


WATER SURFACE AREA: 11 ACRES
CAPACITY 100 Ac Ft (APPROX)
1000
NORMAL POOL E
YATES
BORO.
KEIL POND
480 ACRES
MEADOW RUN POND
LUZERNE COUNTY
LACKAWANNA
41°14'45" N
LLEWELYN'S
CORNERS
SEAUPLAND
CAM
WILKES - BARRE
INTERCHANGE
LOCATION MAP
CARL KEIL POND
BEAR CREEK TOWNSHIP
LUZERNE COUNTY, PENNA
SCALE 1" = 2 M.
DRAINAGE AREA 480 ACRES



NOTE: THE DAM, EMERGENCY SPILLWAY, OUTLET AND WATER SURFACE AREA ARE ENTIRELY WITHIN THE PROPERTY BOUNDARIES OF LAND OWNED BY MR. KEIL

NOTE: RESERVOIR AREA FOR THE PEAK IN THE RUNOFF OF THE EMERGENCY SPILLWAY HAS BEEN ASSUMED BY THE STATE. THE ADDITIONAL STORAGE AREA HAS BEEN ALLOCATED TO THE RESERVOIR AND THE EMERGENCY SPILLWAY FLOW WILL NOT IMPINGE ON THE ROADBANK.

THE RESERVOIR MAIN PLANNED IS INTENDED TO BE USED AS A RECREATION FACILITY.

REVISED 7-63

SCALE 1"=200'

KEIL LAKE

OUTLINE COUNTY, PA

PLAN

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DESIGNED [illegible] 62
DRAWN [illegible] 63
TRACED [illegible]
CHECKED [illegible] 62 [illegible] PA [illegible]

REC'D _____ FOR _____
SEE REPORT NO. _____
_____ C. of Engrs

Approved
C. of Engrs

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

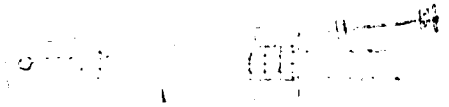
LAKE ALEEDA DAM

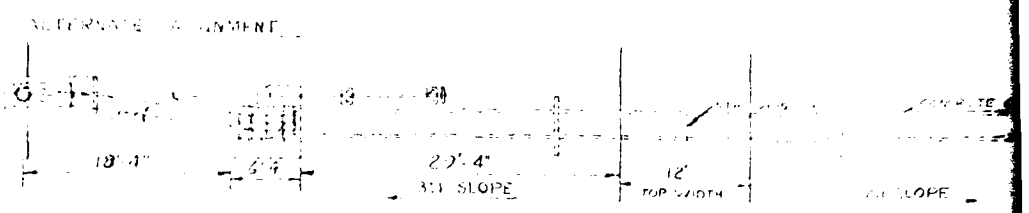
ALEEDA DEVELOPMENT CORPORATION, INC.

PLAN

MAY 1979

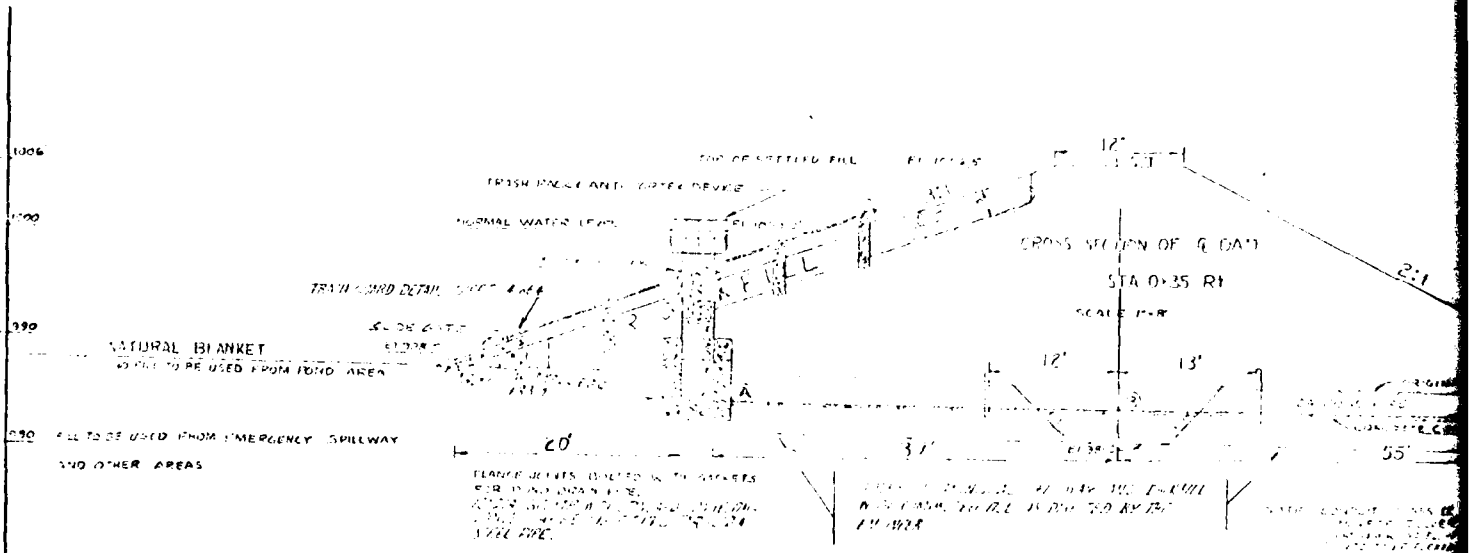
PLATE 2





PLAN VIEW OF EMERGENCY SPILLWAY

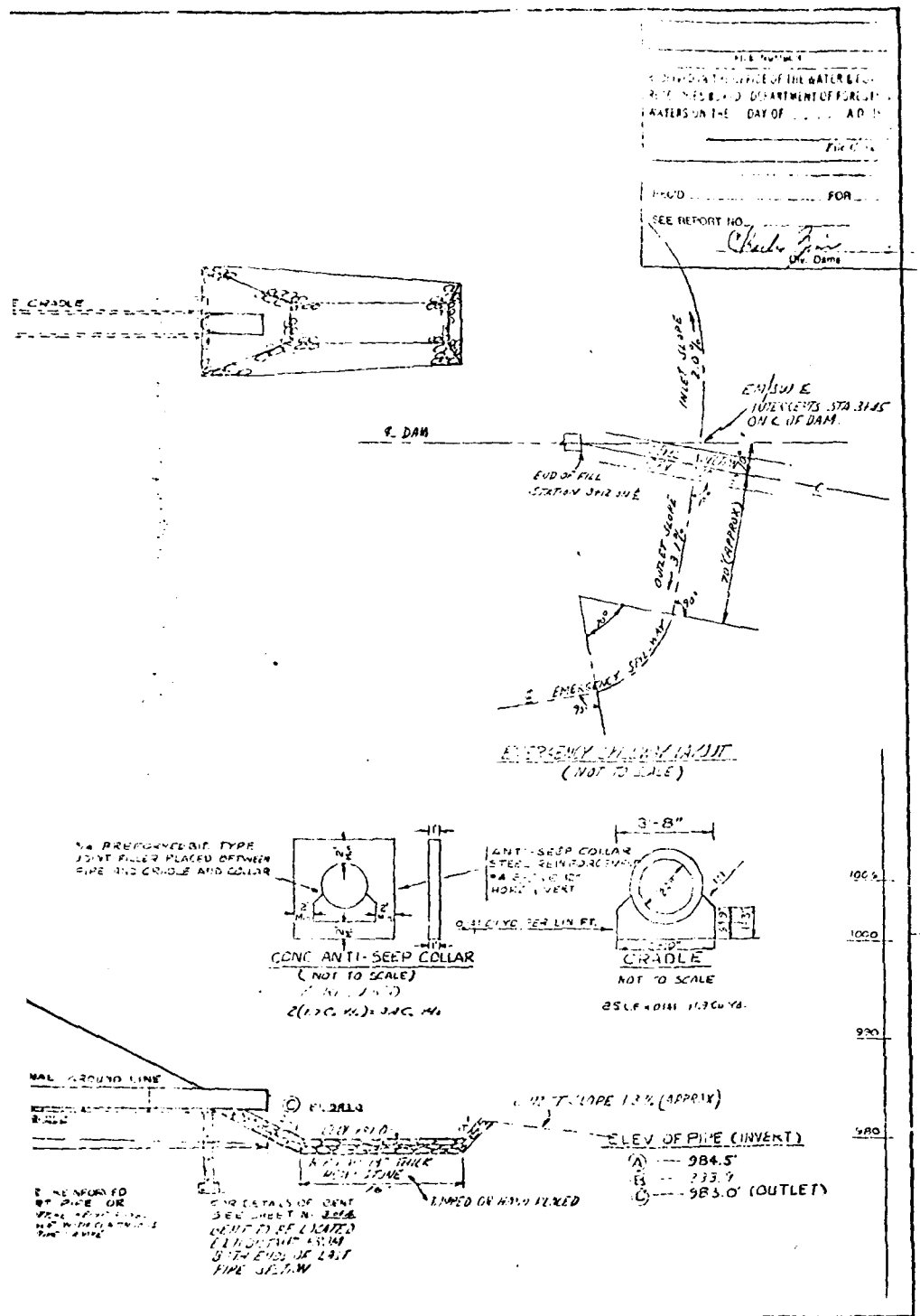
SCALE 1" = 8'



FOR DETAILS OF SLIDE GATE SEE SHEET No. 3 & 4

FOR DETAILS OF RISER SEE SHEET No. 3 & 4

FOR DETAILS OF TRASH RACK & ANTI VORTEX SEE SHEET No. 4 of 4



KEIL LAKE
LUZERNE CO. PENNSYLVANIA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSTRUCTION SERVICE

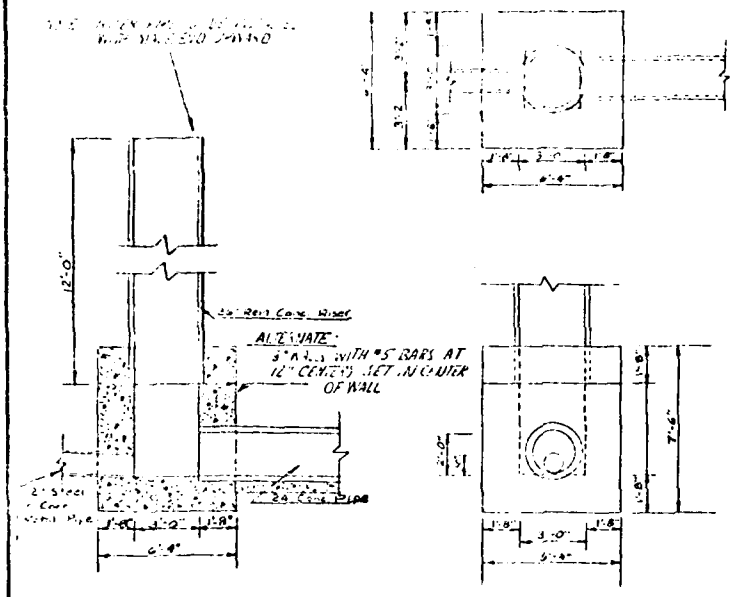
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

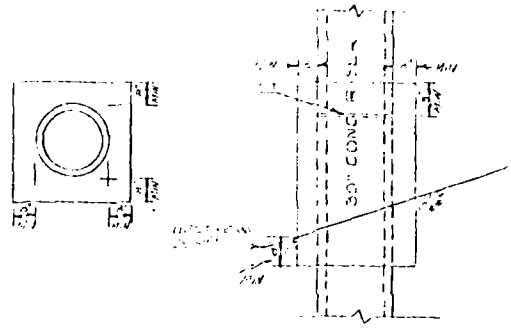
LAKE ALEEDA DAM

ALEEDA DEVELOPMENT CORPORATION, INC.

SECTIONS AND OUTLET WORKS

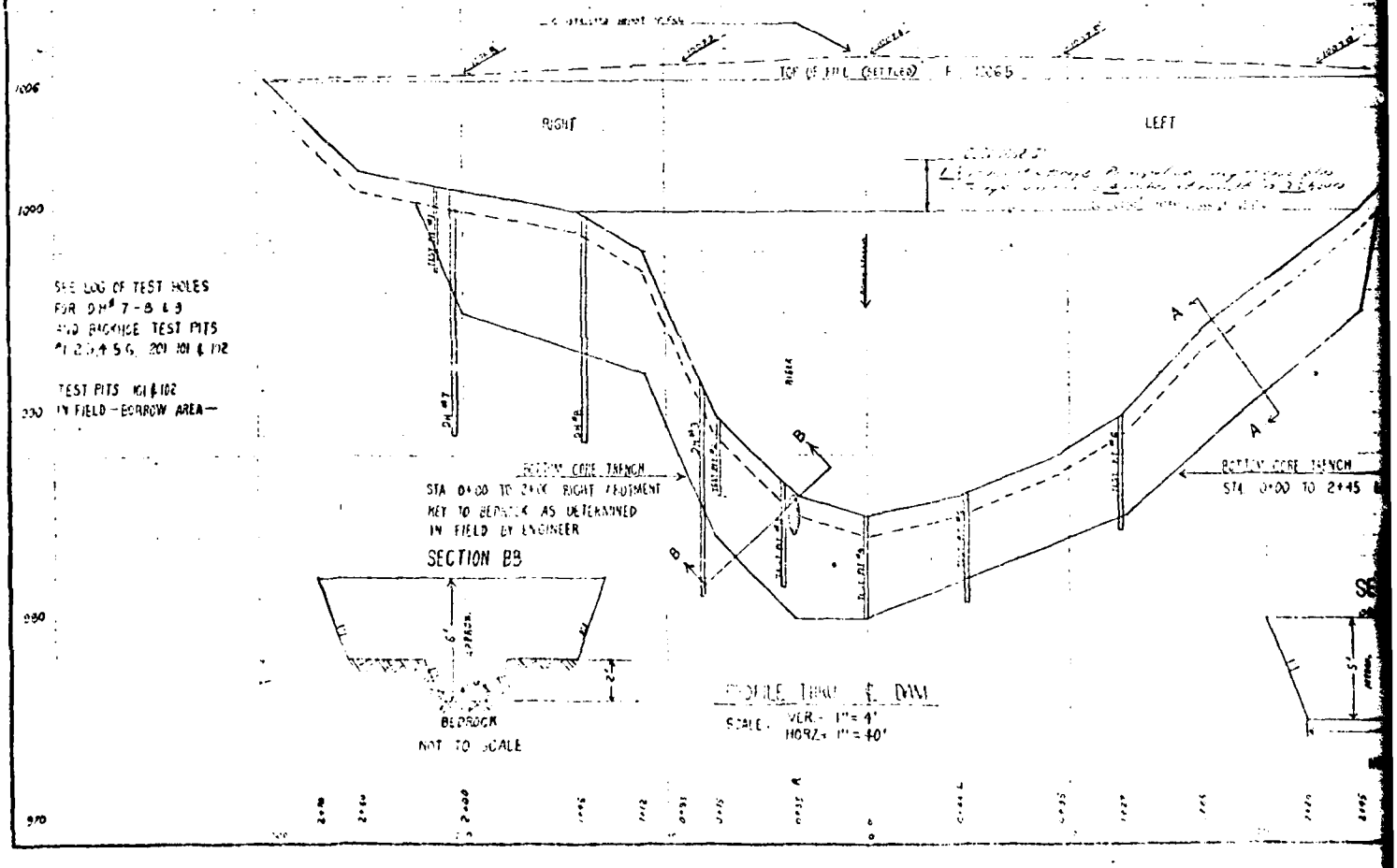
MAY 1979 PLATE 3

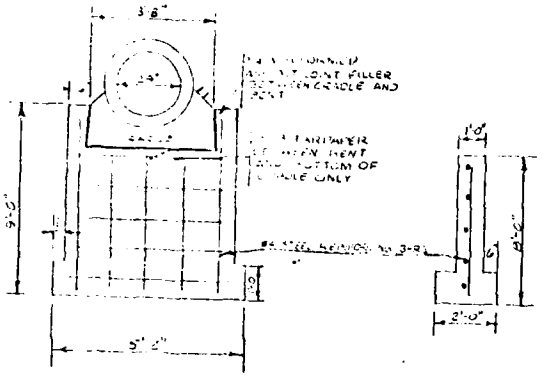




RISER BASE BLOCK
NO SCALE

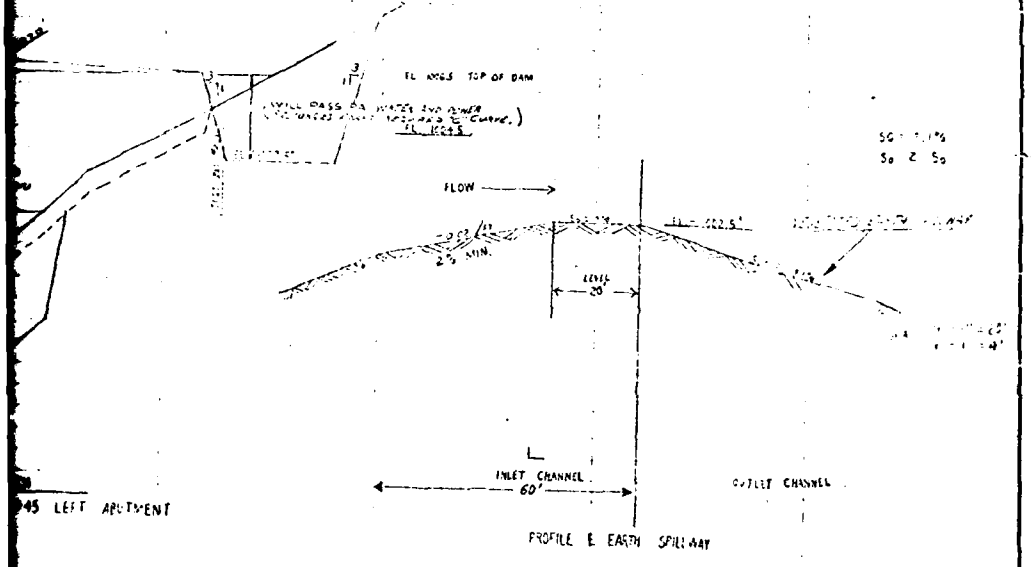
RISER DETAIL
Scale 1" = 4'





NOTE: BENT TO BE PLACED UNDER CENTER OF LAST PIPE SECTION.

BENT
NOT TO SCALE



PROFILE E EARTH SPILLWAY

SECTION AA

NOT TO SCALE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

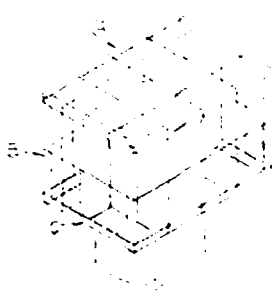
LAKE ALEEDA DAM

ALEEDA DEVELOPMENT CORPORATION, INC.

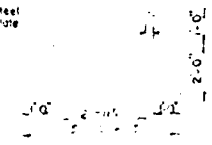
PROFILES AND DETAILS

MAY 1979 PLATE 4

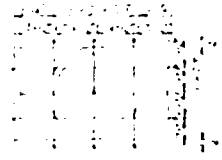
TRASH RACK & ANTI-VORTEX DEVICE



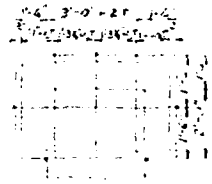
ISOMETRIC VIEW



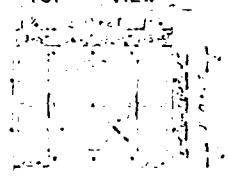
ANTI-VORTEX DEVICE



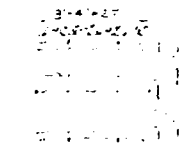
TOP VIEW



SIDE VIEW



BOTTOM VIEW

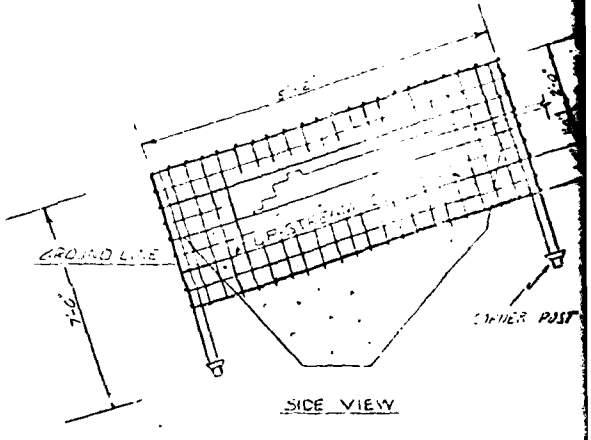


FRONT VIEW

ITEM	SIZE	LENGTH	QUANTITY
ANGLE IRON "A"	[illegible]	[illegible]	4
ANGLE IRON "B"	[illegible]	[illegible]	4
ANGLE IRON "C"	[illegible]	[illegible]	4
REINFORCING BAR	# 4	[illegible]	[illegible]
REINFORCING BAR	# 4	[illegible]	12
REINFORCING BAR	# 4	[illegible]	[illegible]
REINFORCING BAR	# 4	[illegible]	[illegible]
ANTI-VORTEX DEVICE	[illegible]	[illegible]	1

BILL OF MATERIALS

ITEM	SIZE	LE
[illegible]	[illegible]	[illegible]
STEM - SOLID ROLLED STEEL	[illegible]	[illegible]
STEM SPLICE (STEEL)	[illegible]	[illegible]
STEM GUIDE ARMCO TYPE T	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
HANDWHEEL LIFT ARMCO MODEL H-18	[illegible]	[illegible]

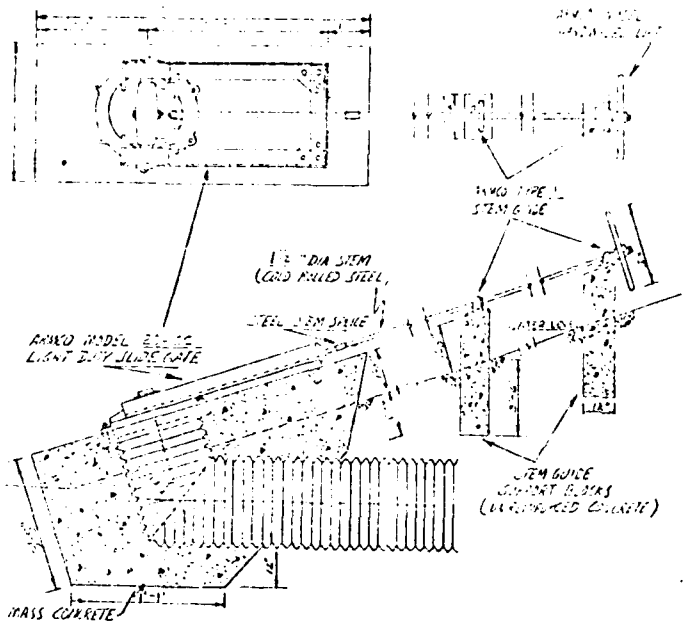


SIDE VIEW

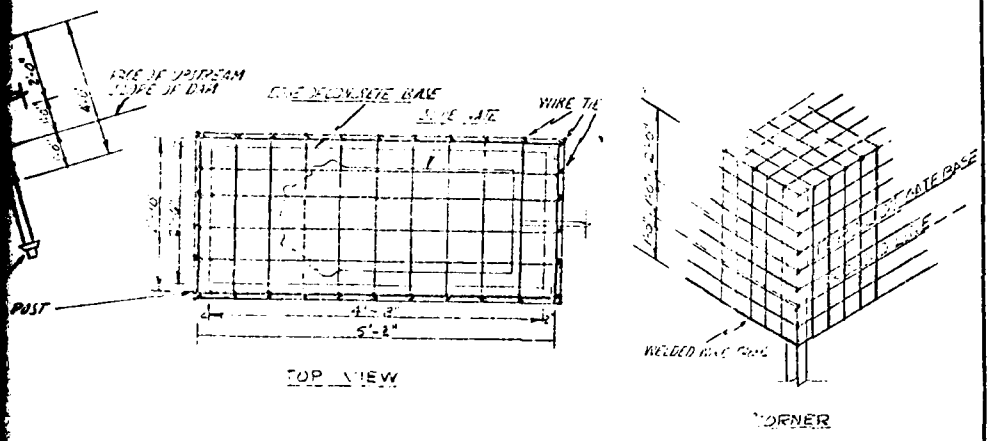
BILL OF MATERIALS

ITEM	SIZE	LE
CORNER POST	[illegible]	[illegible]
WELDED WIRE FABRIC ASTM (SIZE)	6" x 6"	[illegible]
WELDED WIRE FABRIC ASTM (SIZE)	6" x 6"	[illegible]
WELDED WIRE FABRIC ASTM (SIZE)	6" x 6"	[illegible]

SIZE		QUANTITY
12"		1
1¼" DIA	37'	1
		1
		4
18" DIA		1



SLIDE GATE DETAIL
Not To Scale



SIZE	LENGTH	QUANTITY
	7'	4
	4'-0"x5'-2"	2
	2'-0"x4'-0"	2
	2'-0"x5'-2"	1

SLIDE GATE TRASH GUARD
NOT TO SCALE

KEE LAKE
LUZERNE CO., PENNSYLVANIA
SPECIAL FEATURES SHEET 5

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LAKE ALEEDA DAM

ALEEDA DEVELOPMENT CORPORATION, INC.

OUTLET WORKS DETAILS

MAY 1979 PLATE 5

DELAWARE RIVER BASIN

TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

LAKE ALEEDA DAM

NDI ID No. PA-00557
DER ID No. 40-219
SCS ID No. PA-530

ALEEDA DEVELOPMENT CORPORATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

MAY 1979

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: LAKE ALEEDA

NDI ID NO.: PA-00557 DER ID NO.: 40-219

NOTE: SCS REPORTS ALL OF THEIR RECORDS DESTROYED.

ITEM	REMARKS
AS-BUILT DRAWINGS	NONE
REGIONAL VICINITY MAP	SEE PLATE 1
CONSTRUCTION HISTORY	BUILT 1964-1965 FILL AND "TOE DRAIN" ADDED SOME TIME LATER.
TYPICAL SECTIONS OF DAM	SEE PLATE 3
OUTLETS: Plan Details Constraints Discharge Ratings	SEE PLATES 3, 4, AND 5 NO DISCHARGE RATING.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NONE
DESIGN REPORTS	ANALYSIS by COMMONWEALTH
GEOLOGY REPORTS	NONE
DESIGN COMPUTATIONS: Hydrology and Hydraulics (H&H) Dam Stability Seepage Studies	H&H ANALYSIS FOR MAIN SPILLWAY. HYDRAULICS FOR AUXILIARY SPILLWAY. NO OTHER DATA.
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	BORING RECORDS AVAILABLE. NO ANALYSIS OF BORINGS
POSTCONSTRUCTION SURVEYS OF DAM	NONE

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	NOT NOTED.
MONITORING SYSTEMS	NONE
MODIFICATIONS	TOE DRAIN TO RIGHT OF CONDUIT AND FILL ON DOWNSTREAM SLOPE ADDED.
HIGH POOL RECORDS	POOL APPROXIMATELY AT AUXILIARY SPILLWAY CREST DURING TROPICAL STORM AGNES, JUNE, 1972.
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	SLOUGHING OF DOWNSTREAM SLOPE.

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	NONE
SPILLWAY: Plan Sections Details	MAIN SPILLWAY: SEE PLATES 3, 4, AND 5 AUXILIARY SPILLWAY: SEE PLATES 2 AND 3.
OPERATING EQUIPMENT: Plans Details	SEE PLATE 5
PREVIOUS INSPECTIONS Dates Deficiencies	NONE

DELAWARE RIVER BASIN

TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

LAKE ALEEDA DAM

NDI ID No. PA-00557
DER ID No. 40-219
SCS ID No. PA-530

ALEEDA DEVELOPMENT CORPORATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

MAY 1979

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: LAKE ALEEDA County: LUZERNE State: PENNSYLVANIA

NDI ID No.: PA-00557 DER ID No.: 40-219

Type of Dam: HOMOGENEOUS EARTHFILL Hazard Category: HIGH

Date(s) Inspection: 3 MAY 1979 Weather: OVERCAST Temperature: 50°F

SOIL CONDITIONS: MOIST

Pool Elevation at Time of Inspection: 1920.0 msl/Tailwater at Time of Inspection: 1900.4 msl

Inspection Personnel:

C. KEIL (ALEEDA)

D. WOLF (GFCC)

D. EBERSOLE (GFCC)

A. WHITMAN (GFCC) Recorder

B-1

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	NONE	
CREST ALIGNMENT: Vertical Horizontal	HORIZONTAL - No deficiencies VERTICAL - SEE SURVEY DATA FOLLOWING INSPECTION FORMS	
RIPRAP FAILURES	NONE	

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	NO DEFICIENCIES	
ANY NOTICEABLE SEEPAGE	50' DOWNSTREAM TO LEFT OF OUTLET CHANNEL - 0.5 gpm ± FROM DRAIN - 2 TO 3 gpm	"YELLOW BOY" AT BOTH
STAFF GAGE AND RECORDER	NONE	
DRAINS	SEE SEEPAGE	

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT		
INTAKE STRUCTURE	SUBMERGED	
OUTLET STRUCTURE		
OUTLET CHANNEL		
EMERGENCY GATE	GATE STEM IS RUSTY.	OWNER DECLINED TO OPERATE GATE. HE FEARED THE GATE WOULD BE STUCK OPEN.

MAIN
UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Observed submerged No deficiencies noted.	
APPROACH CHANNEL	Reservoir	
DISCHARGE CHANNEL	No deficiencies	
BRIDGE AND PIERS	None	

AUXILIARY SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	GRASS-LINED CHANNEL UNEVEN GRADING	
APPROACH CHANNEL	SHORT GRASS-LINED CHANNEL. WET AND SOFT IN AREAS	WET AREA is Above POOL ELEVATION.
DISCHARGE CHANNEL	FLOW WOULD TRAVEL ALONG EMBANKMENT TOE.	
BRIDGE AND PIERS	NONE	
GATES AND OPERATION EQUIPMENT	NONE	

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE	
OBSERVATION WELLS	NONE	
WEIRS	NONE	
PIEZOMETERS	NONE	
OTHER	NONE	

RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	GENTLE	
SEDIMENTATION	NONE NOTED	
WATERSHED DESCRIPTION	ROLLING HILLS. ONLY DEVELOPED SPARSELY AROUND LAKE	

B-8

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	2 - 6' DIAMETER CULVERTS UNDER 10' HIGH ROADWAY EMBANKMENT	
SLOPES	GENTLE	
APPROXIMATE NUMBER OF HOMES AND POPULATION	NONE UNTIL BEAR CREEK LAKE DAM ABOUT 5 MILES DOWNSTREAM.	

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. _____ OF _____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

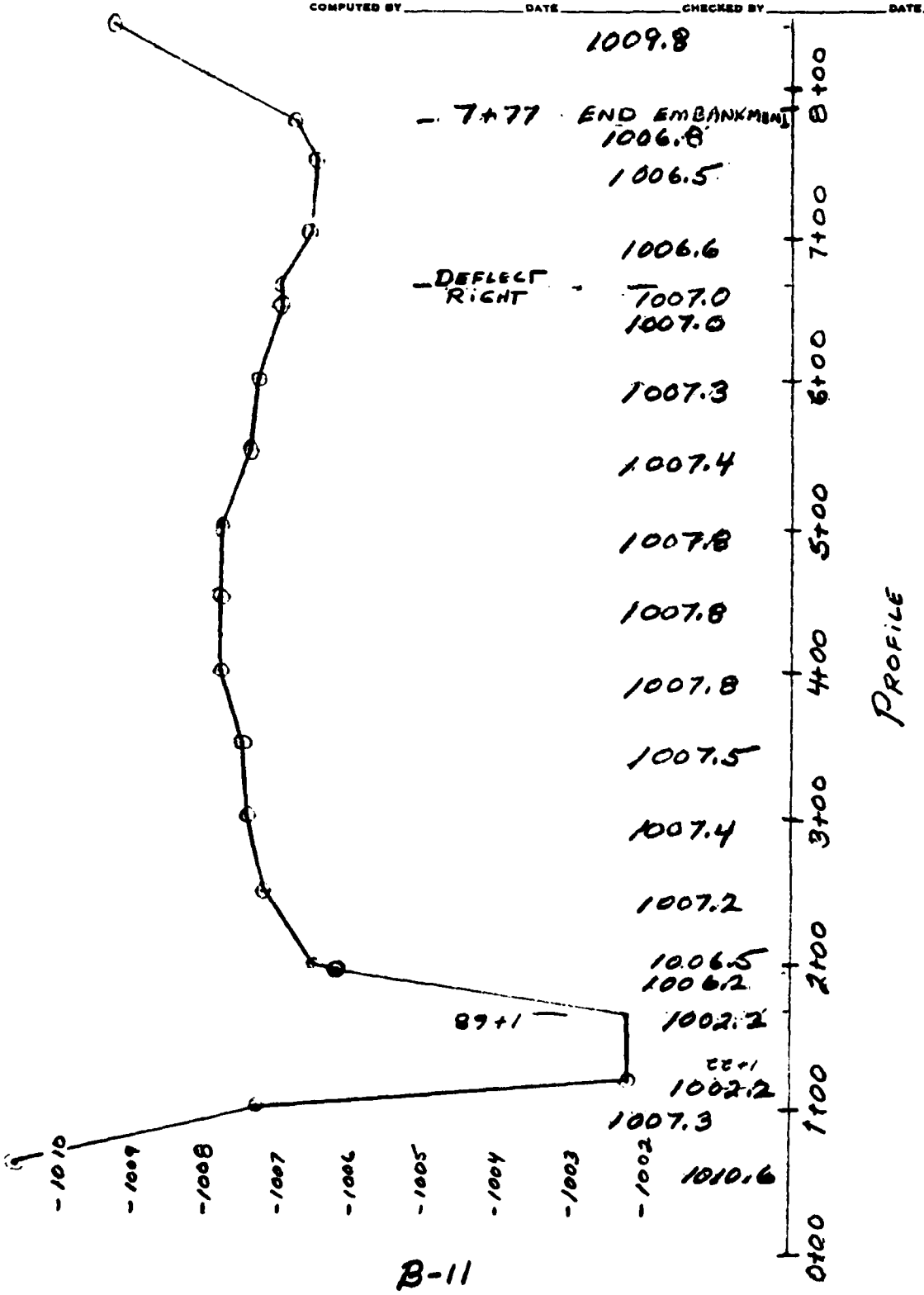
NOTE:

DESIGN DATUM FOR THE DRAWINGS IS EL 1000.0 AT TOP OF ROADWAY CREST. THE WATER SURFACE ON THE USGS PHOTOREVISED MAP CROSSES THE EL. 1920 CONTOUR. AN APPROXIMATE CONVERSION IS EL 1000.0 (DRAWINGS) = EL 1920.0 (USGS).

9313

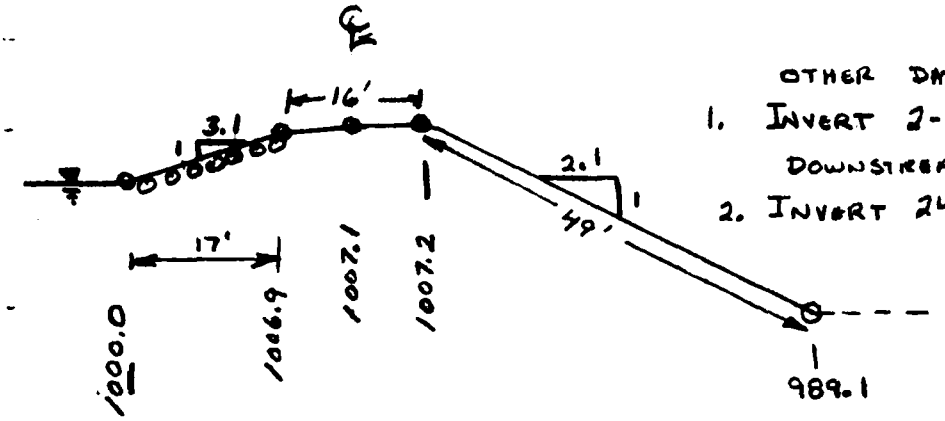
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT LAKE ALEEDA FILE NO.
SHEET NO. OF SHEETS
FOR
COMPUTED BY DATE CHECKED BY DATE



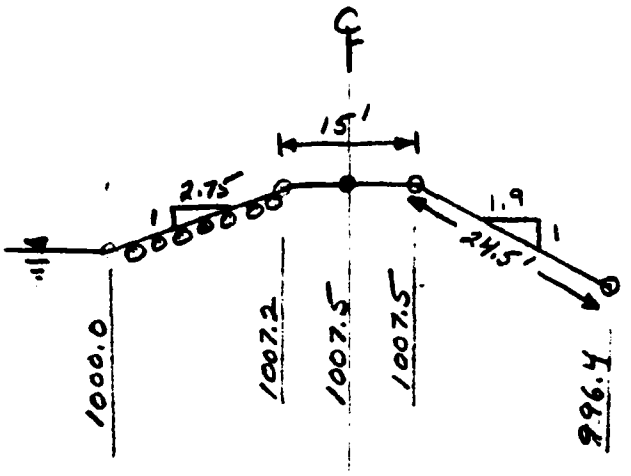
B-11

8513



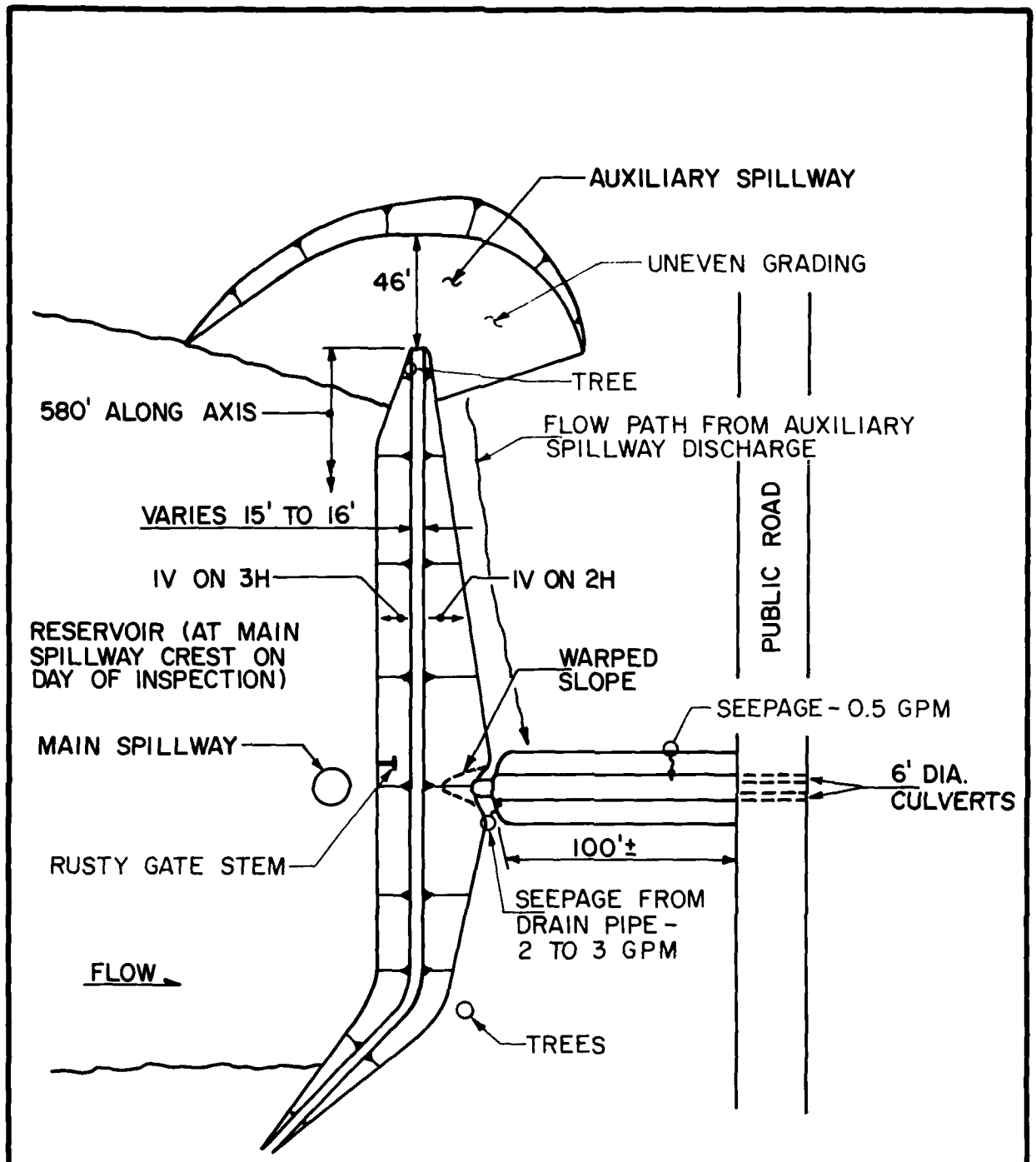
SECTION AT STA 5+33
SCALE 1" = 20'

OTHER DATA
1. INVERT 2-72" CULVERTS DOWNSTREAM = 979.9
2. INVERT 24" CIP = 980.0



SECTION AT STA 3+50

NOTE: SURVEY DATA PRESENTED ON THIS PAGE AND ON THE PREVIOUS PAGE WAS ORIGINALLY ACQUIRED ASSUMING DATUM AT THE INVERT OF THE 24" RCP, EL 983.0. THE RESULTING ELEVATIONS WERE NOT CONSISTENT WITH THE DESIGN DRAWINGS. DATUM WAS THEN ADJUSTED TO EL 1000.0, THE DESIGN SPILLWAY CREST. THIS PLACES THE INVERT OF THE 24" RCP AT EL. 980.0



NOT TO SCALE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LAKE ALEEDA DAM

ALEEDA DEVELOPMENT CORPORATION, INC.

RESULTS OF VISUAL INSPECTION

MAY 1979 PLATE B-1

DELAWARE RIVER BASIN

TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

LAKE ALEEDA DAM

NDI ID No. PA-00557
DER ID NO. 40-219
SCS ID No. PA-530

ALEEDA DEVELOPMENT CORPORATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

MAY 1979

APPENDIX C

HYDROLOGY AND HYDRAULICS

APPENDIX C

HYDROLOGY AND HYDRAULICS

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

APPENDIX C

DELAWARE River Basin

Name of Stream: TRIBUTARY TO BEAR CREEK

Name of Dam: LAKE ALEEDA

NDI ID No.: PA-00557

DER ID No.: 40-219

Latitude: N 41° 14' 45" Longitude: W 75° 43' 00"

Top of Dam (~~low-spot~~) Elevation: 1926.5

Streambed Elevation: 1900.0 Height of Dam: 27 ft

Reservoir Storage at Top of Dam Elevation: 818 acre-ft

Size Category: SMALL

Hazard Category: HIGH (see Section 5)

Spillway Design Flood: VARIES PMF TO 1/2 PMF

SELECT 1/2 PMF BECAUSE BEAR CREEK DOWNSTREAM HAS SDF = 1/2 PMF

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
NONE				

DOWNSTREAM DAMS

BEAR CREEK	5.0	17	765	HIGH HAZARD
				NDI - PA-00545
				DER 40-47

DELAWARE River Basin

Name of Stream: TRIBUTARY TO BEAR CREEK

Name of Dam: LAKE ALEEDA

~~NDB ID No.~~: _____

~~DER ID No.~~: _____

Latitude: N 41° 14' 45" Longitude: W 75° 43' 00"

DETERMINATION OF PMF RAINFALL

For Area A

which consists of Subareas A1 of 0.55 sq. mile

_____ _____

_____ _____

_____ _____

_____ _____

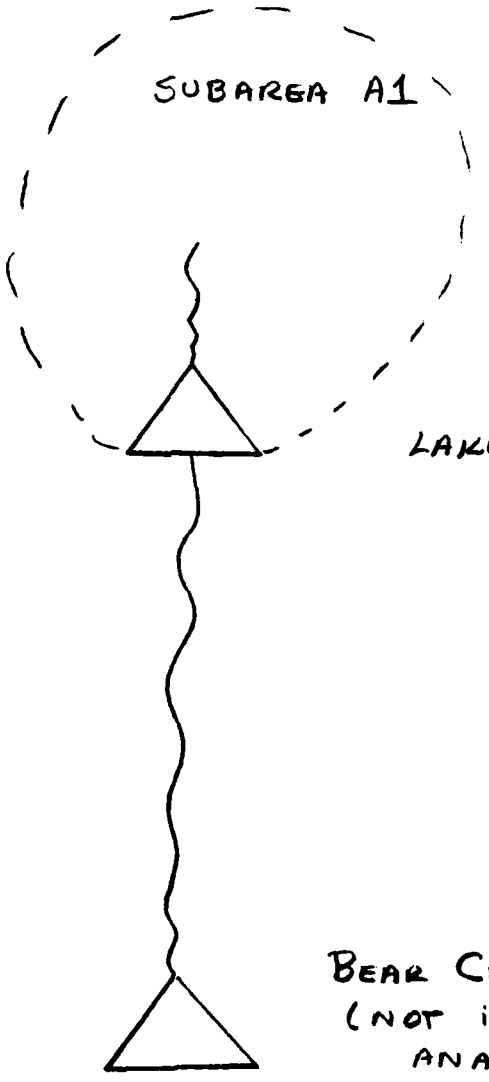
Total Drainage Area 0.55 sq. mile

PMF Rainfall Index = 22.0 in., 24 hr., 200 sq. mile

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone	N/A	1
Geographic Adjustment Factor	N/A	1.0
Revised Index Rainfall	N/A	

RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	111
12 hours	123
24 hours	133
48 hours	142
72 hours	
96 hours	


SUBAREA A1
LAKE ALEEDA DAM
BEAR CREEK LAKE DAM
(NOT INCLUDED IN
ANALYSIS)

Data for Dam at Outlet of Subarea A1
(see Sketch on Sheet C-4)

Name of Dam: LAKE ALEEDA Sheet 1 of __

Height: 27 FT. (~~existing~~)

Spillway Data:	Existing Conditions	Design Conditions
Top of Dam Elevation	SAME AS	1926.5
Spillway Crest Elevation	DESIGN	1920.0
Spillway Head Available (ft)		6.5
Type Spillway		DROP SPILLWAY (SCS)
"C" Value - Spillway		SEE NEXT SHEETS
Crest Length - Spillway (ft)		" " "
Spillway Peak Discharge (cfs)		60±
Auxiliary Spillway Crest Elevation		1922.5
Auxiliary Spillway Head Available (ft)		4.0
Type Auxiliary Spillway		EARTH CUT OPEN GRASS CHANNEL WITH CONTROL SECTION
"C" Value - Auxiliary Spillway		
Crest Length - Auxiliary Spillway (ft)		SEE NEXT SHEETS
Auxiliary Spillway Peak Discharge (cfs)		
Combined Spillway Discharge (cfs)		

Spillway Rating Curve: SEE DATA ON NEXT SHEETS

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

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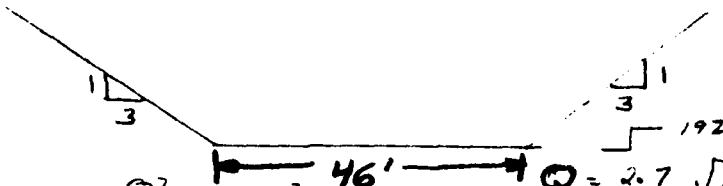
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

Auxiliary Spillway



$hv = \frac{Q^2}{64.36 A^2} = V^2/2g$ $\quad Q = \frac{2.7}{3.1}\sqrt{\frac{A^3 g}{T}}$ CRITICAL DEPTH

WATER SURFACE	AREA	TOPWIDTH	Q	hv	POOL ELEV
1922.5	0	46	0	0	1922.5
1923.0	23.75	49	82	.18	1923.2
1923.5	49	52	235	.36	1923.9
1924.0	75.75	55	439	0.52	1924.5
1924.5	104	58	686	0.68	1925.2
1925.0	133.75	61	978	0.83	1925.8
1925.5	165	64	1309	0.98	1926.5
1926.5	232	70	2087	1.26	1927.8

6513

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FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

COMBINED OUTFLOW CURVE

POOL ELEV	Q AUXILIARY SPILLWAY	ASSUMED TAILWATER	Q MAIN SPILLWAY	ΣQ
1920	0	1900	0	0
1921	0	1901	29*	29
1922	0	1901	72	72
1922.5	0	1901	73	73
1923.2	82	1910	57	139
1923.9	235	1910	59	294
1924.5	439	1911	58	497
1925.2	688	1911	59	747
1925.8	978	1912	59	1037
1926.5	1309	1912	60	1369
1927.8	2087	1913	61	2148

SHIFT IN TAILWATER

$Q = 1.97\sqrt{2g(\text{POOL} - \text{TAILWATER})}$

SEE NEXT SHEET

* WEIR CONTROL

SUMMARY

POOL ELEV	ΣQ (ROUNDED)
1920	0
1921	30
1922	70
1922.5	75
1923.2	140
1924.5	500
1925.2	750
1925.8	1040
1926.5	1370
1927.8	2150

Data for Dam at Outlet of Subarea A1

Name of Dam: LAKE ALLEGAN Sheet 2 of

Outlet Works Rating:	Outlet Works ← Outlet 1	Spillway → Outlet 2	Outlet 3
Invert of Outlet	1900.0	1900.0	—
Invert of Inlet	1908.5	—	1920.0
Type	STEEL PIPE	RCP	RCP
Diameter (ft) = D	1	2	3
Length (ft) = L	20	92	16'±
Area (sq. ft) = A	.785	3.14	7.07
N	.012	.013	.013
K Entrance	0.5	0.3	0.3
K Exit	N/A	1.0	N/A
K Friction* = $29.1 n^2 L/R^{4/3}$	0.532	1.14	.115
Sum of K (REF TO 24" PIPE) ΣK	1.032 16.51	2.44 2.44	.415 .082
ΣK TOTAL	18.95	2.52	
$(1/K)^{0.5} = C$	.23	.63	
Maximum Head (ft) = HM	20.0	16.5	
$Q = C A \sqrt{2g(HM)}$ (cfs)	26	60	
~~Q Combined (cfs)~~			

POOL AT MAIN SPILLWAY CREST
TAILWATER ASSUMED
AT EL 1900.0
FOR OUTLET WORKS
RATING

$\Sigma K' = \Sigma K \left(\frac{A_1}{A_2}\right)^2$

A_1 = 24" pipe area

TAILWATER
ASSUMED AT
EL 1912.0
FOR SPILLWAY
RATING

* R = Hydraulic Radius = (Area/Wetted Perimeter) = D/4 for Circular Conduits.

Data for Dam at Outlet of Subarea A1

Name of Dam: LAKE ALEEDA Sheet 3 of ___

Storage Data:

Elevation	Area (acres)	Storage million gals	Storage acre-ft	Remarks
1900.3 = ELEVO*	0	0	0	
1920.0 = ELEV1	61 = A1		400 = S1	DESIGN DATA
1922.5	63.6		55.6	INTERPOLATED
1926.5	67.8		818	INTERPOLATED
1940 **	83			
**				

* ELEVO = ELEV1 - $(3S_1/A_1)$

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Top of Dam is 17 percent of watershed.

Remarks: ___

DELAWARE River Basin

Name of Stream: TRIBUTARY TO BEAR CREEK

Name of Dam: LAKE ALEEDA

~~NDS ID No.:~~ _____

~~DER ID No.:~~ _____

Latitude: N 41° 14' 45" Longitude: W 75° 43'00"

Drainage Area: 0.55 sq. mile

Data for Subarea: A1 (see Sketch on Sheet C-4)

Name of Dam at Outlet of Subarea: LAKE ALEEDA

Drainage Area of Subarea: 0.55 sq. mile

Subarea Characteristics:

Assumed Losses: 1.0-inch initial abstraction + 0.05 in/hr

The following are measured from outlet of subarea to the point noted:

L = Length of Main Watercourse extended to the divide = 1.02 mile

L_{CA} = Length of Main Watercourse to the centroid = 0.38 mile

From NAB Data: AREA 2 PLATE B

Cp = 0.45

C_T = 2.10

CENTROID FALLS AT EDGE RESERVOIR
LENGTH CENTROID TO DIVIDE = 0.64 mile
$Tp = 2.1 (0.64)^{0.6} = 1.61$
NOT USED

$Tp = C_T \times (L \times L_{CA})^{0.3}$ = 1.58 (hrs)

Flow at Start of Storm = 1.5 cfs/sq. mile x Subarea D.A = 0.83 cfs

Computer Data:

QRCSN = -0.05 (5% of peak flow)

RTIOR = 2.0

Remarks: _____

Selected Computer Output

Multi-Ratio Analysis

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
    1                A                                NATIONAL DAM INSPECTION PROGRAM
    2                A                                    TRIBUTARY TO BEAR CREEK
    3                A                                        LAKE ALEEDA DAM
    4                P    300        0       15        0        0        0        0        0       -4        0
    5                B1     5
    6                J      1        6        1
    7                J1     1       .9       .8       .7       .6       .5
    8                K      0        1                                          1
    9                K1       RUNOFF INTO LAKE ALEEDA
   10                M      1        1     0.55                0.55
   11                P              22.0      111      123      133      142
   12                T                                                        1      .05                .17
   13                M   1.58     0.45
   14                P   -1.5    -0.05      2.0
   15                K      1        1                                          1
   16                K1       ROUTE THROUGH LAKE ALEEDA
   17                Y                                 1
   18                Y1     1                                                -1920       -1
   19                Y4  1920     1921     1922   1922.5   1923.2   1926.5   1925.2   1925.8   1926.5   1927.8
   20                Y5     0       30       70       75      140      500      750     1040     1370     2150
   21                $A     0       61       83
   22                $E1900.3     1920     1940
   23                $$  1920
   24                $D1926.5      3.1      1.5      580
   25                K     99
```

C-12

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS					
				RATIO 1 1.00	RATIO 2 .90	RATIO 3 .80	RATIO 4 .70	RATIO 5 .60	RATIO 6 .50
HYDROGRAPH AT	1	.55	1	1246.	1122.	997.	872.	748.	623.
	(	1.42)	(	35.29)(	31.77)(	28.24)(	24.71)(	21.18)(	17.65)(
ROUTED TO	1	.55	1	759.	648.	534.	429.	327.	220.
	(	1.42)	(	21.50)(	18.34)(	15.13)(	12.16)(	9.26)(	6.23)(

C-13

SUMMARY OF DAM SAFETY ANALYSIS

LAKE ALEEDA DAM

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1920.00	1920.00	1926.50
STORAGE	401.	401.	919.
OUTFLOW	0.	0.	1370.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1926.22	0.00	777.	759.	0.00	43.75	0.00
.90	1924.91	0.00	713.	648.	0.00	44.00	0.00
.80	1924.60	0.00	692.	536.	0.00	44.00	0.00
.70	1926.25	0.00	669.	429.	0.00	44.25	0.00
.60	1923.88	0.00	647.	327.	0.00	44.75	0.00
.50	1923.69	0.00	620.	220.	0.00	45.25	0.00

H-1 D

GANNETT FLEMING CORDDRY
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HARRISBURG, PA.

SUBJECT _____ FILE NO. _____

SHEET NO. ____ OF ____ SHEETS

FOR _____

COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

RESULTS OF ANALYSIS

PMF RAINFALL = 24.99"

	PMF	½ PMF
RUNOFF (INCHES)	23.0	11.5
PEAK INFLOW (CFS)	1246	623
PEAK OUTFLOW (CFS)	759	220
FREEBOARD (FT)	1.28	3.01

DELAWARE RIVER BASIN

TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

LAKE ALEEDA DAM

NDI ID No. PA-00557
DER ID No. 40-219
SCS ID No. PA-530

ALEEDA DEVELOPMENT CORPORATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

MAY 1979

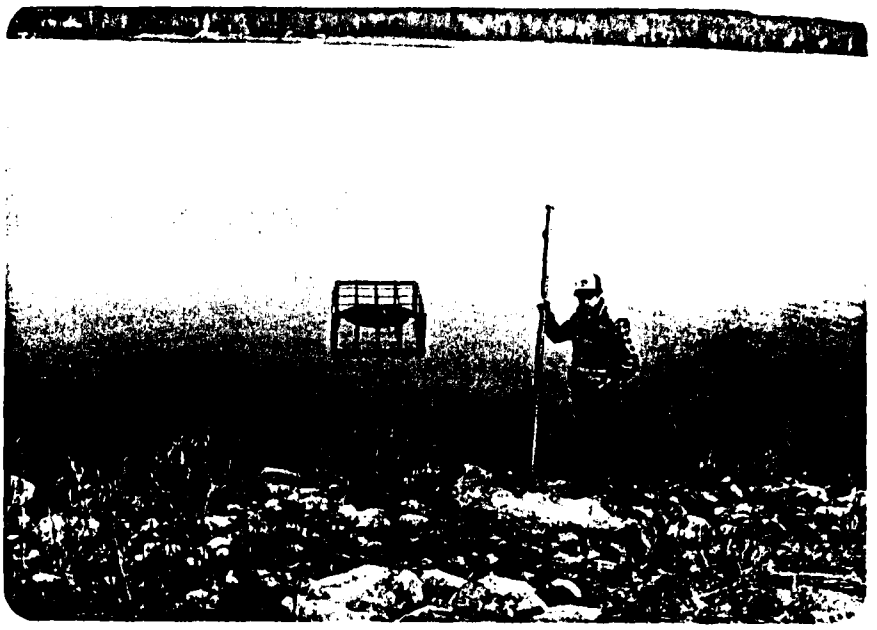
APPENDIX D

PHOTOGRAPHS

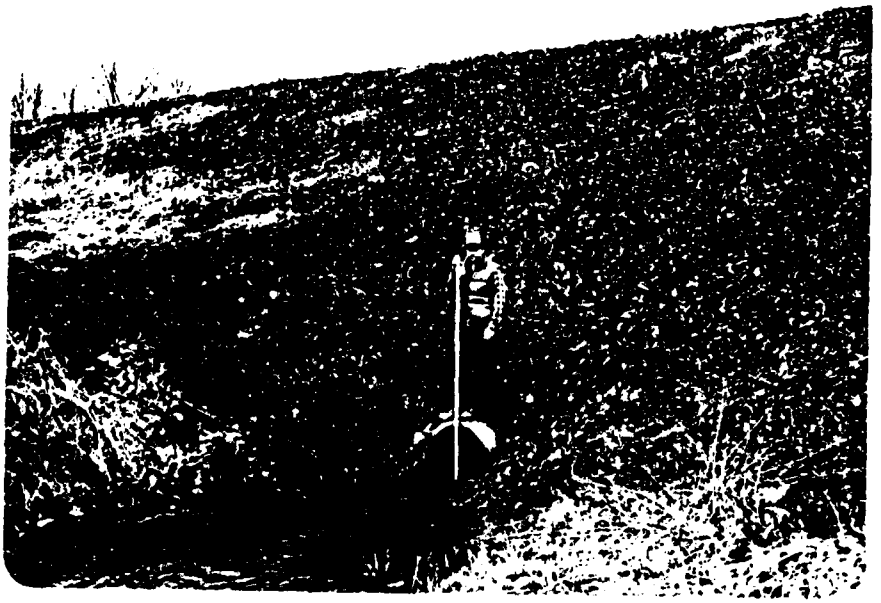
LAKE ALEEDA DAM

A. Upstream Slope

B. Downstream Slope



C. Main Spillway and Gate Stem



D. Conduit Outfall

E. Roadway Culverts Downstream of Dam

F. Auxiliary Spillway Approach Channel

G. Auxiliary Spillway Crest

H. Auxiliary Spillway Exit Channel

DELAWARE RIVER BASIN

TRIBUTARY TO BEAR CREEK, LUZERNE COUNTY

PENNSYLVANIA

LAKE ALEEDA DAM

NDI ID No. PA-00557
DER ID No. 40-219
SCS ID No. PA-530

ALEEDA DEVELOPMENT CORPORATION, INC.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

MAY 1979

APPENDIX E

GEOLOGY

LAKE ALEEDA DAM

APPENDIX E

GEOLOGY

1. General Geology. The damsite and reservoir are located in Luzerne County. The rock formations exposed in Luzerne County range from the the Post-Pottsville formations, of Pennsylvanian Age, down to the Onondaga formation of Middle Devonian Age. The Wisconsin terminal moraine crosses the southern part of the County, and the greater part of the County is covered by glacial drift. Extensive deposits of glacial outwash occur along the Susquehanna River and less extensive deposits along the smaller streams.

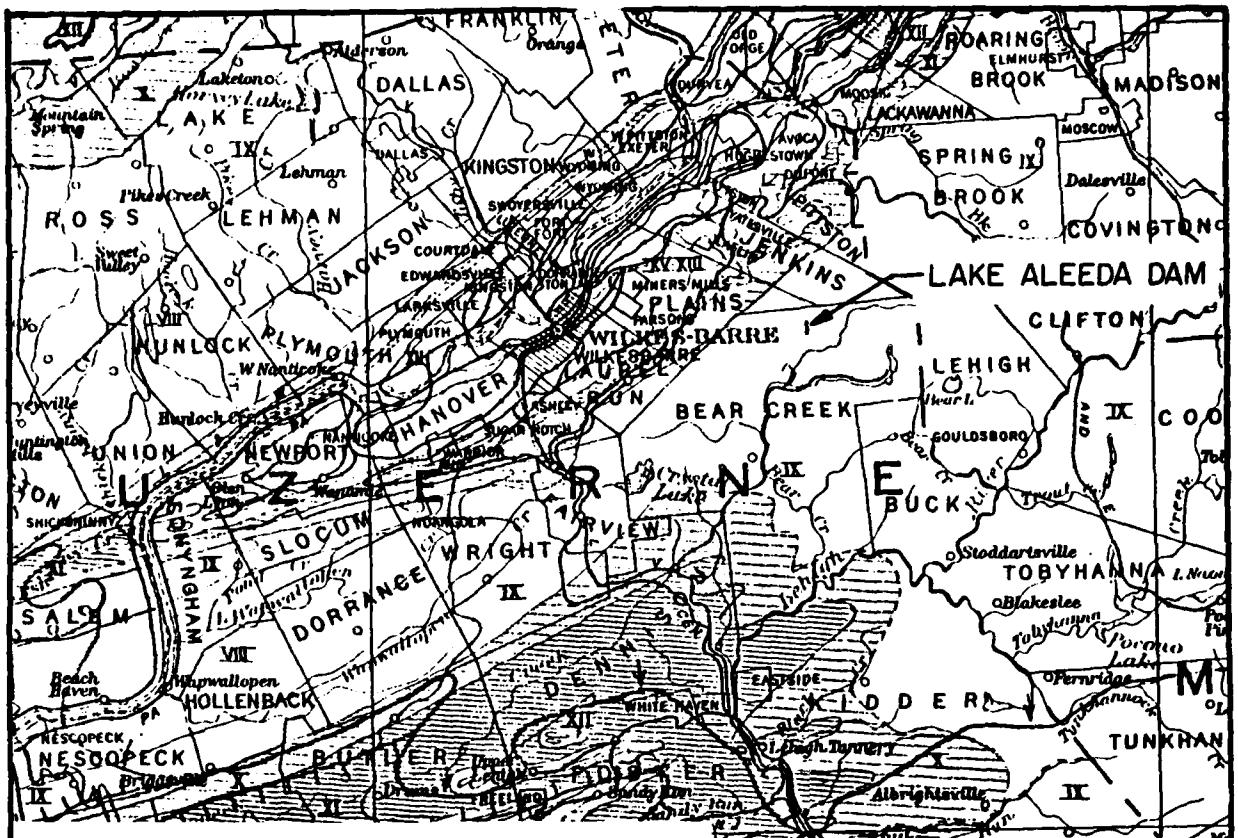
Nearly all of Luzerne County lies in the Valley and Ridge Province in which nearly all the rocks have been strongly folded. In going from north to south across the County, five major folds are encountered, all of which trend northeast. The first of these is a shallow syncline on the crest of North Mountain, forming the Mehoopnay coal basin. The second is the Milton Anticline, which exposes the Portage group in the northwestern part of the County and gradually flattens out toward the northeast. The third and most pronounced is the Lackawanna Syncline, which originates in Lackawanna County to the north, and has preserved the post-Pottsville formations throughout the Wyoming Valley. The maximum depth of this syncline is reached in the vicinity of Wilkes-Barre and Plymouth. The double rim of this syncline is formed by the resistant Pottsville formation and Pocono sandstone, separated by the less resistant Mauch Chunk shale. The fourth fold is the Berwick (Montour) Anticline, which exposes a few feet of the Onondag formation in the vicinity of Beach Haven. This fold reaches its maximum development farther west and only the eastern portion reaches

Luzerne County. The fifth major fold comprises a series of anticlines and synclines forming the Eastern Middle Anthracite Field in the vicinity of Hazleton. The synclinal basins in this region are relatively shallow and there are large areas from which all coalbeds have been eroded.

The general dips of the region vary from 0° to 40°, and the maximum dips are found on the rims and within the synclinal coal basins. The relatively soft post-Pottsville beds in their cores are severely folded and contorted with numerous minor faults. The northern and easternmost parts of the County border the Appalachian Plateau Province and are characterized by horizontal, or nearly horizontal strata. The Catskill continental group of rocks underlies those part of Luzerne County that are outside of the five major folds.

2. Site Geology. The right abutment of Lake Aleeda Dam is founded on gray, medium-grained sandstone in the Catskill formation of Devonian Age. The Catskill formation is composed of shale, siltstone, and claystone; fine-to-medium-grained sandstone, and medium-to-coarse-grained conglomerates. Crossbedding, channeling and cut-and-fill features are common to the sandstone and conglomerate units. Bedding is usually well developed with thicknesses ranging from less than one foot to ten to sixteen feet in coarser beds. Joints are generally open and are either dipping steeply or vertical. The shales are very susceptible to weathering; the sandstones and conglomerates are moderately resistant.

Except for the right abutment, the dam is founded on overburden, which is mostly classified as a lean clay.



GLACIAL BORDERS

Border of Wisconsin drift

Border of Illinoian drift

Border of Jerseyan drift

(includes some areas of questionable glaciation)

Glacial drift

IV

Lower sandstones of Clinton formation, Tuscarora sandstone and Juniata formation

V

Cayuga group (except Tonoloway and Bossardville limestone) and Clinton formation (except lower sandstones)

VI

Helderberg, Tonoloway (in west) and Bossardville (in east) limestones

VII

Oriskany sandstone

VIII

Chemung formation, Portage group, Hamilton formation, Marcellus shale and Onondaga formation

IX

Catskill continental group

X

Pocono sandstone

XI

Mauch Chunk shale

XII

Pottsville formation

XIII

Post-Pottsville formations

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LAKE ALEEDA DAM

ALEEDA DEVELOPMENT CORPORATION, INC.

GEOLOGIC MAP

MAY 1979

PLATE E-1